

Focus Questions

1. How are the parts of an experiments identified?
2. What makes an experiment credible or valid?
(not bogus)

<http://studyjams.scholastic.com/studyjams/jams/science/scientific-inquiry/scientific-methods.htm>

<http://studyjams.scholastic.com/studyjams/jams/science/scientific-inquiry/scientific-theory-and-evid.htm>

<http://studyjams.scholastic.com/studyjams/jams/science/scientific-inquiry/collect-data.htm>

Focus

Cause – manipulated variable – thing experimenter changes

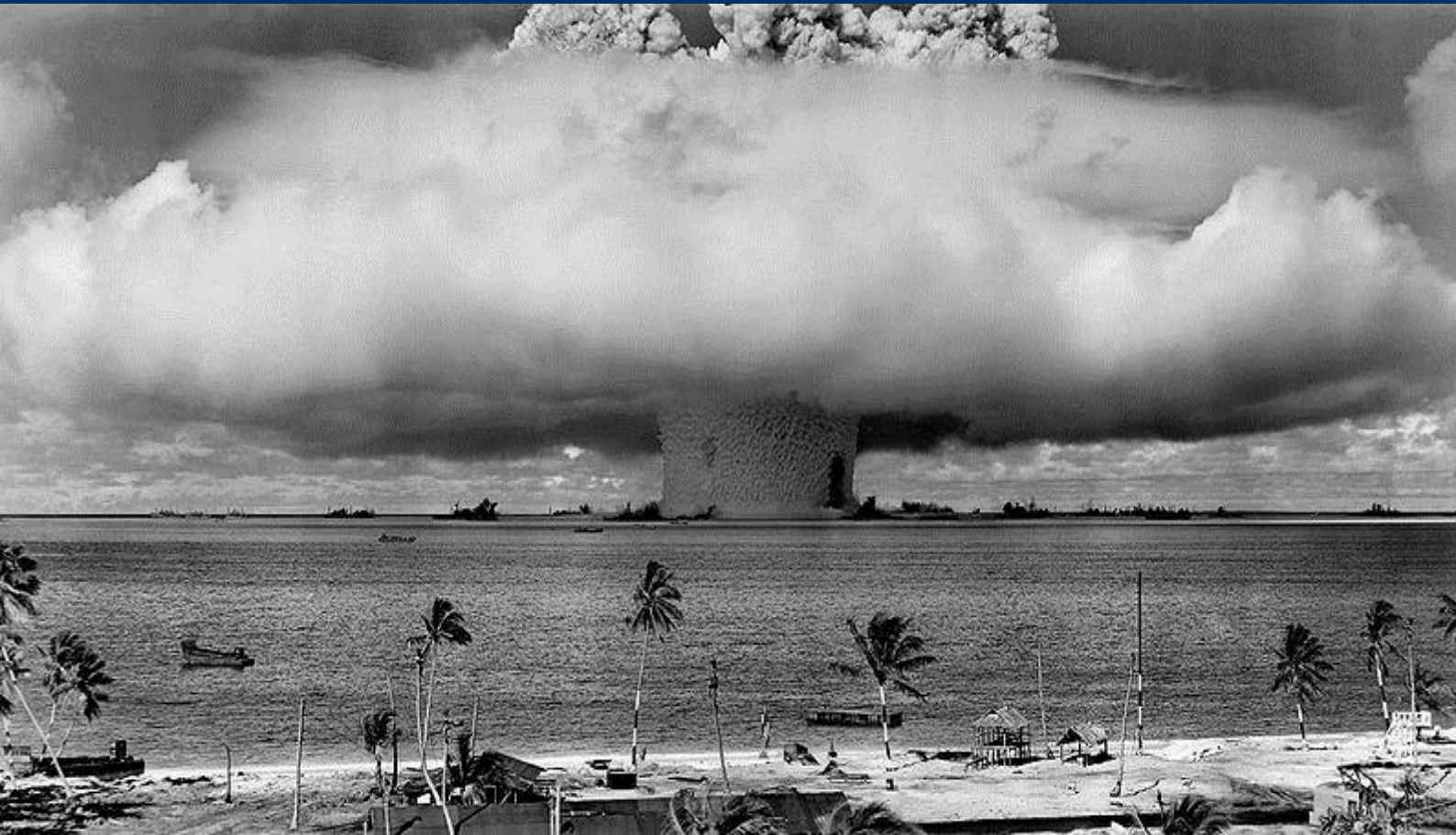
Effect – responding variable – thing measured or observed
– depends on the manipulated variable



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Controlled Variable - variables that are kept the same

Control subjects or group - are used as a comparison and are not experimented on

SpongeBob Experiments



Bikini Atoll is above Bikini Bottom
Not Cornell style.

SpongeBob Experiments

Scientific Method:

Make a hypothesis

Design an experiment

Collect and interpret the data

Draw conclusions

Communicate results

The Bikini Bottom gang loves science class and wanted to do a little research. Read the description for each experiment and use your knowledge of the scientific method to answer the questions.

(Not Cornell style and don't write the stories.)

SpongeBob Experiments

Flower Power:

SpongeBob loves to garden and wants to grow lots of pink flowers for his pal Sandy. He bought a special Flower Power fertilizer to see if it will help plants produce more flowers.



Flower Power:

1A. The manipulated variable is...

SpongeBob Experiments

SpongeBob loves to garden and wants to grow lots of pink flowers for his pal Sandy. He bought a special Flower Power fertilizer to see if it will help plants produce more flowers.



Flower Power:

1A. The manipulated variable is...

1B. The responding variable is...



SpongeBob Experiments

SpongeBob loves to garden and wants to grow lots of pink flowers for his pal Sandy. He bought a special Flower Power fertilizer to see if it will help plants produce more flowers.

Flower Power:

1C. Hypothesis:

Write a hypothesis for SpongeBob.



SpongeBob Experiments

SpongeBob loves to garden and wants to grow lots of pink flowers for his pal Sandy. He bought a special Flower Power fertilizer to see if it will help plants produce more flowers.



Flower Power:

1C. Hypothesis: Fertilized plants will produce more flowers.

He plants two plants of the same size in separate containers with the same amount of potting soil.

1D. Variables kept the same are...



He plants two plants of the same size in separate containers with the same amount of potting soil.

1D. Variables kept the same are plant and pot size.

He places one plant in a sunny window and waters it every day with fertilized water. He places the other plant on a shelf in a closet and waters it with plain water every other day.



1E. The plant getting plain water is the...

1F. The variables not controlled are...

He places one plant in a sunny window and waters it every day with fertilized water. He places the other plant on a shelf in a closet and waters it with plain water every other day.

1E. The plant getting plain water is the control used for comparison.

1F. The variables not controlled are...

He places one plant in a sunny window and waters it every day with fertilized water. He places the other plant on a shelf in a closet and waters it with plain water every other day.

1E. The plant getting plain water is the control used for comparison.

1F. The variables not controlled are the amount of sunlight and water.

He places one plant in a sunny window and waters it every day with fertilized water. He places the other plant on a shelf in a closet and waters it with plain water every other day.

Only one variable should be different between the experimental and control groups.

1G. Tell how to fix this experiment.

Super Snails

Gary is not the smartest snail in Bikini Bottom and believes he can improve his brain power by eating Super Snail Snacks. In order to test this hypothesis, he recruits SpongeBob and several snail friends to help him with the experiment.



Super Snails

Gary believes he can improve his brain power by eating Super Snail Snacks.

Super Snails

2A. The manipulated variable is...

2B. The responding variable is...



Gary is not the smartest snail in Bikini Bottom and believes he can improve his brain power by eating Super Snail Snacks.

2C. Hypothesis:

.....



The snails ate one snack with each meal every day for three weeks. SpongeBob created a test and gave it to the snails before they started eating the snacks as well as after three weeks.

How could this experiment be improved?



2D. Control: Add a snail that gets snacks.



Interpreting the data:

2E. Does the data support the hypothesis/ do the Super Snail Snacks work? Most of the snails showed , so the snacks work.

Test Results

Snail	Before	After
Gary	64%	80%
Larry	78%	78%
Barry	82%	84%
Terry	72%	70%

2F. Results produced by beliefs or expectations are called the placebo effect.

Pair share: Quickly state to the person next to you if you think Gary's improved test grade was due to the snacks or placebo effect.



Bubble Time

Patrick loves bubble gum and would like to be able to blow bigger bubbles than anyone else in Bikini Bottom.



To prepare for the Bikini Bottom Big Bubble Blowout, he bought five different brands of bubble gum and needs your help to find the brand that creates the biggest bubbles.

Bubble Time

3A. The manipulated variable is ...

3B. The responding variable is ...



3C. The are compared, so they act kind of like controls.

3D. Hypothesis: Help Patrick win the contest by writing a hypothesis for him.

3E. Write an experiment to test which brand produces the biggest bubble. Experiments test the hypothesis.



Mr. Krabs wants to make Bikini Bottoms a nicer place to live. He has created a new sauce that he thinks will reduce the production of body gas associated with eating krabby patties from the Krusty Krab.



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Patty Power

4A. The manipulated variable is...

4B. The responding variable is...

- He recruits 100 customers with a history of gas problems.
 - He has 50 of them (Group A) eat crabby patties with the new sauce.
 - The other 50 (Group B) eat crabby patties with sauce that looks just like new sauce but is really just mixture of mayonnaise and food coloring.
 - Both groups were told that they were getting the sauce that would reduce gas production.
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- He has 50 of them (Group A) eat crabby patties with the new sauce.
- The other 50 (Group B) eat crabby patties with a mixture of mayonnaise and food coloring.

4C. Group is the control.



Two hours after eating the crabby patties, 30 customers in group A reported having fewer gas problems and 8 customers in group B reported having fewer gas problems.

4D. Mr. Krabs' should conclude that..

4E. 8 people in group B reported less gas due to the...

Slimotosis

Sponge Bob notices that his pal Gary is suffering from slimotosis, which occurs when the shell develops a nasty slime and gives off a horrible odor. His friend Patrick tells him that rubbing seaweed on the shell is the perfect cure, while Sandy says that drinking Dr. Kelp will be a better cure.

Slimotosis

5A. The manipulated variable is...

5B. The responding variable...

SpongeBob decides to test this cure by rubbing Gary with seaweed for 1 week and having him drink Dr. Kelp. After a week of treatment, the slime is gone and Gary's shell smells better.

5C. Hypothesis:

5D. Conclusion: What should Spongebob conclude?

SpongeBob decides to test this cure by rubbing Gary with seaweed for 1 week and having him drink Dr. Kelp.

5E. What is wrong with this experiment.
Experiment was not designed to handle...
How can this experiment be improved?

SpongeBob decides to test this cure by rubbing Gary with seaweed for 1 week and having him drink Dr. Kelp.

5F. Find more snails with slimtosis.

- **Rub one with kelp.**
 - **Have another snail drink Dr. Kelp.**
 - **Rub the third snail with kelp and have it drink Dr. Kelp.**
 - **Use the fourth snail as a control giving it no treatment.**
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Microwave Miracle

Patrick believes that fish that eat food exposed to microwaves will become smarter and would be able to swim through a maze faster.

6A. The independent variable is...

6B. The dependent variable is...



Microwave Miracle

Patrick believes that fish that eat food exposed to microwaves will become smarter and would be able to swim through a maze faster.

6C. Hypothesis:



Patrick decides to perform an experiment by placing fish food in a microwave for 20 seconds. He has the fish swim through a maze and records the time it takes for each one to make it to the end.



He feeds the special food to 10 fish and gives regular food to 10 others. After 1 week, he has the fish swim through the maze again and records the times for each.

6D. The fish getting regular food are the...

**6E. Look at the results in the charts.
What should Patrick's conclusion be?
(Analysis on next slide)**



Special Food Group

(Time in minutes/seconds)

Fish	Before	After
1	1:06	1:00
2	1:54	1:20
3	2:04	1:57
4	2:15	2:20
5	1:27	1:20
6	1:45	1:40
7	1:00	1:15
8	1:28	1:26
9	1:09	1:00
10	2:00	1:43

Regular Food Group

(Time in minutes/seconds)

Fish	Before	After
1	1:09	1:08
2	1:45	1:30
3	2:00	2:05
4	1:30	1:23
5	1:28	1:24
6	2:09	2:00
7	1:25	1:19
8	1:00	1:15
9	2:04	1:57
10	1:34	1:30

#7 *Learning Scientific Method*

6E. Patrick should conclude that...

Averages for Both Groups			
Special Food Group		Regular Food Group	
01:35.80	01:30.10	01:36.40	01:33.10
5.7 sec improvement		3.3 sec improvement	

Squidward's Symphony

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played.

7A. The manipulated variable is...

Squidward's Symphony

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played.

7A. The manipulated variable is...

7B. The responding variable is...

Squidward's Symphony

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played.

7C. Hypothesis:

In order to test his hypothesis, Squidward played a song on his clarinet for a total of 5 minutes and counted the number of jellyfish he saw in his front yard. He played the song a total of 3 times on his clarinet and repeated the experiment using a flute and a guitar. He also recorded the number of jellyfish he observed when he was not playing an instrument. The results are shown in the chart.

7D. How does music vs. no music affect the number of jellyfish? More jelly fish are present music than music.

(How does the clarinet vs. the guitar affect the number of jellyfish?)

7E. The hypothesis was not supported because...

Number of Jellyfish/Instrument

Trial	No Music	Clarinet	Flute	Guitar
1	5	15	5	12
2	3	10	8	18
3	2	12	9	7

Super Bubbles

Patrick and SpongeBob love to blow bubbles! Patrick found some Super Bubble Soap at Sail-Mart. The ads claim that Super Bubble Soap will produce bubbles that are twice as big as bubbles made with regular bubble soap. Patrick and SpongeBob made up two samples of bubble solution.

8A. The manipulated variable is...

8B. The responding variable is...

The ads claim that Super Bubble Soap will produce bubbles that are twice as big as bubbles made with regular bubble soap.

8C. Hypothesis:



#7 Learning Scientific Method

One sample was made with 5 oz. of Super Bubble Soap and 5 oz. of water, while the other was made with 5 oz. of regular bubble soap and 5 oz. of water. Patrick and SpongeBob used their favorite bubble wands to blow 10 different bubbles and did their best to measure the diameter of each one.

8D. The regular soap mix is the...

Results are shown in the chart.

D. Calculate the average diameter for each bubble solution.

Super Bubble
= _____ cm

Regular Soap
= _____ cm

Bubbles
(Diameter in centimeters)

Bubble	Super Bubble	Regular Soap
1	15	10
2	10	5
3	12	16
4	18	14
5	22	11
6	13	12
7	16	11
8	18	15
9	15	15
10	12	6

What if Patrick
used the super
mix and
SpongeBob
used the regular
mix?

What if Patrick
is a better
bubble blower?

What if Patrick
is a worse
bubble blower?

Bubbles
(Diameter in centimeters)

Bubble	Super Bubble	Regular Soap
1	15	10
2	10	5
3	12	16
4	18	14
5	22	11
6	13	12
7	16	11
8	18	15
9	15	15
10	12	6

8E. What should their conclusion be?
If both Patrick and SpongeBob blew 5
bubbles with each mix, then the
hypothesis is ... supported because...



Krusty Krabs Breath Mints

Mr. Krabs created a secret ingredient for a breath mint that he thinks will “cure” the bad breath people get from eating crabby patties at the Krusty Krab. He asked 100 customers with a history of bad breath to try his new breath mint.

9A. The manipulated variable is...

9B. The responding variable is...

He had fifty customers (Group A) eat a breath mint after they finished eating a crabby patty. The other fifty (Group B) also received a breath mint after they finished the sandwich, however, it was just a regular breath mint and did not have the secret ingredient. Both groups were told that they were getting the breath mint that would cure their bad breath.

9C. Group B was the ...

Two hours after eating the crabby patties, thirty customers in Group A and ten customers in Group B reported having better breath than they normally had after eating crabby patties.

9D. Hypothesis:

9E. What should be Krabs' conclusion?

9F. Ten group B people reported better breath because of...

SpongeBob Clean Pants

SpongeBob noticed that his favorite pants were not as clean as they used to be. His friend Sandy told him that he should try using Clean-O detergent, a new brand of laundry soap she found at Sail-Mart.

10A. The Independent variable is...

10B. The Dependent Variable is...

SpongeBob made sure to wash one pair of pants in plain water and another pair in water with the Clean-O detergent. After washing both pairs of pants a total of three times, the pants washed in the Clean-O detergent did not appear to be any cleaner than the pants washed in plain water.

10C. Hypothesis.....

10D. What should Sponge Bob's conclusion be?

Marshmallow Muscles

Larry was told that a certain muscle cream was the newest best thing on the market and claims to double a person's muscle power when used as part of a muscle-building workout. Interested in this product, he buys the special muscle cream and recruits Patrick and SpongeBob to help him with an experiment.

Marshmallow Muscles

Larry was told that a certain muscle cream claims to double a person's muscle power when used as part of a muscle-building workout.

11A. The manipulated variable is...

11B. The responding variable is...

Marshmallow Muscles

Larry was told that a certain muscle cream claims to double a person's muscle power when used as part of a muscle-building workout.

11C. Hypothesis:

What is the prediction?

Larry develops a special marshmallow weight-lifting program for Patrick and SpongeBob. He meets with them once every day for a period of 2 weeks and keeps track of their results. Before each session Patrick's arms and back are lathered in the muscle cream, while Sponge Bob's arms and back are lathered with the regular lotion.

11D. The control in this experiment is...

Time	Patrick	SpongeBob
Initial Amount	18	5
After 1 week	24	9
After 2 weeks	33	17

Did SpongeBob's muscle power stay the same, double, or triple?

Did Patrick's muscle power even double?

Did the gains come from the workout routine or the cream?

11E. What should Larry's conclusion be?

Time	Patrick	SpongeBob
Initial Amount	18	5
After 1 week	24	9
After 2 weeks	33	17